REMARKS

This is a response to the Office Action dated October 19, 2006. Claims 25-30 are pending in this application. Reconsideration of this application in view of the following remarks is respectfully requested.

Claim Rejections under 35 U.S.C. 103

In paragraphs 1-2 of the present Office Action, the Examiner maintained the rejection originally stated in the February 22, 2006 Office Action of claims 25-30 as being unpatentable under 35 U.S.C. 103(a) over U.S. Patent No. 5,542,073 to Schiefer et al. ("Schiefer").

The Office Action stated that applicant's arguments presented in the July 21, 2006 Response have been fully considered, but were not found persuasive. The Office Action further stated that arguments in the July 21 Response are disagreed with, and that the previous Office Action had given detailed explanations of claimed limitation[s] and pointed out the exact locations in the cited prior art.

Applicant respectfully disagrees and submits that Schiefer does not disclose, teach, or suggest all of the limitations of claims 25-30, as alleged in the Office Actions. Applicant maintains all arguments of the July 21, 2006 Response, because they are believed to be correct. Additionally, as shown below, the "exact locations in the cited prior art," alleged to disclose, teach, or suggest claim limitations fail to do so, and Schiefer does not render the claims of the present application obvious.

The Office Action recognizes (at p. 2) that "obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art." When making the obviousness rejections over Schiefer, however, the Office Action does not show any teaching, suggestion, or motivation to modify Schiefer or to combine Schiefer with any other prior art reference. Therefore, it appears that the conclusion of obviousness is based solely on the knowledge generally available to one of ordinary skill in the art. However, "it is never appropriate to rely solely on 'common knowledge' in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based." *Zurko*, 258 F.3d at 1385, 59 USPQ2d at 1697. As the court held in *Zurko*, "an assessment of basic knowledge and common sense that is not based on any evidence in the record lacks substantial evidence support." *Id.* at 1385." (MPEP 2144.03).

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Here, the Office Action has reached the conclusion of obviousness of claims 25-30 relying solely on alleged common knowledge in the art without evidentiary support in the record. Should the obviousness rejections of the claims over the Schiefer reference be maintained, applicant respectfully requests the showing of substantial evidence support regarding the level of knowledge of a person of ordinary skill in the art, as required by the Federal Circuit precedent.

As was explained in the July 21, 2006 Response, the present application relates to the underlying structure of a database and, in particular, to storing data in new ways that provide an advantage in space usage and/or speed of access over conventional record-based tables. As described in the specification, the underlying data structures include, for example, "instance" and "connectivity" information, where instance information identifies instances of each value in a field that is in a record and connectivity information associates each instance with a specific instance of a value in another field. In certain described embodiments, structures containing cardinality information are used to associate instances with values and/or vice versa.

Schiefer in contrast does not relate to or describe the underlying structures in which data in a database are stored. Instead, Schiefer describes a query optimizer and, in particular, a method for estimating join result sizes used in query optimization. (*See, e.g.*, Schiefer, col. 5, l. 63 - col. 6, l. 62). The query optimization techniques in Schiefer do not require a database having any particular underlying structure and apply to conventionally structured databases. Schiefer simply does not disclose or suggest the structures and techniques claimed in the present application.

Applicant agrees with the statement in the Office Action indicating that the pending claims must be given the broadest reasonable interpretation consistent with the specification (pg. 2) and acknowledges a superficial similarity of certain terms also used in Schiefer, (for example, cardinality). The point of disagreement is that the analysis in the Office Action stops at the level of identifying in Schiefer terms similar to those recited in the instant claims but, as explained below, ignores the context of the claims. As a result, the Office Action improperly asserts that the art of record, in combination with certain unidentified knowledge available to one of ordinary skill, would render the instant claims obvious. But this is incorrect. Applicant makes no claim to have invented, for example, the concept of "cardinality" or a "cardinality store" in the abstract context of database design. Rather, these concepts are used as tools to properly disclose and explain to the skilled artisans the subject

matter which applicant regards as his invention. This subject matter is defined in the claims, which the prior art of record simply fails to disclose, teach or suggest.

Turning to the specific rejections, with respect to claim 25, the Office Action alleges (at p. 5) that the limitations of "a collection of a number of instances corresponding to a value of a first attribute; a cardinality element corresponding to the number of instances; wherein at least one instance indicates at least one other instance corresponding to a value of a second attribute and the second attribute is different from the first attribute" are taught by Schiefer in the Abstract and in the disclosure at col. 2, ll. 41-56. Applicant respectfully disagrees for the following reasons.

The Schiefer's Abstract reads as follows:

A method for choosing join selectivities in a query optimizer in a relational database management system is disclosed which facilitates the estimation of join result sizes by a query optimizer in a relational database system, wherein a new relation R is to be joined with an intermediate relation I, and wherein the selectivity values for each eligible join predicate are known. The method has the steps of determining the equivalence classes for a plurality of join attributes and then computing for each relation an estimate of the cardinality and the number of distinct values in each attribute after all the local predicates have been included. These are used in further computation of join selectivities and join result sizes. The join predicates must then be processed by correctly choosing the join selectivities. The join result sizes can then be correctly calculated;

and Schiefer's disclosure at col. 2, ll. 41-56 reads as follows:

If a local predicate is present, the local predicate may serve to reduce the cardinality of the relation. As an example, given the full EMPLOYEE relation and the local predicate (EMPLOYEE.Age >50), performing the selection operation involving the local predicate serves to extract only those employees whose ages are greater than 50. The number of employees in this result is clearly smaller than the number of employees in the full EMPLOYEE relation. This reduced cardinality is called the effective cardinality of the relation. It can be used in other cardinality calculations, e.g., for estimating join result sizes. The local predicates can change the effective cardinality of the relation and the number of distinct values in the attributes of the relation thus changing the size of the final join result. What is also needed in the art is an algorithm for taking the effect of local predicates into account.

Claim 25 recites, *inter alia*, a system comprising "a collection of a number of instances corresponding to a value of a first attribute" and "a cardinality element corresponding to the number of instances" of that value of the first attribute. The cardinality

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element recited in claim 25 thus contains information regarding the number of instances of an attribute having a particular value. Schiefer simply does not disclose such a cardinality element. Schiefer instead describes two kinds of statistics, (1) the number of tuples contained in a relation, which Schiefer refers to as "the relation's cardinality," and (2) the number of distinct values taken by an attribute. (Schiefer, col. 1, ll. 39-44). However, neither of these statistics is a cardinality element containing information regarding the number of instances of an attribute having a particular value or suggests such a cardinality element.

The Office Action goes on to state that "Schiefer teaches that effective cardinality should be determine[d] when the value of particular attribution changes, therefore, it would have been obvious to a person of ordinary skill in the computer art at the time the invention was [made] to update or change or modify cardinality in order to efficiently evaluation the cost estimate to obtain the lowest execution cost (column 3, lines 21-32)." Schiefer's disclosure at col. 3, l. 21-32 reads as follows:

> There may be several alternative query plans generated by the query optimizer, each specifying a set of operations to be executed by the RDBMS. The many query plans generated for a single query ultimately differ in their total cost of obtaining the desired data. The query optimizer then evaluates these cost estimates for each query plan in order to determine which plan has the lowest execution cost. In order to determine a query plan with the lowest execution cost, the query optimizer uses specific combinations of operations to collect and retrieve the desired data. When a query plan is finally selected and executed, the data requested by the user is retrieved according to that specific query plan however manipulated or rearranged.

First, contrary to the allegations in the Office Action, Schiefer, at col. 3, ll. 21-31, does not teach "that effective cardinality should be determined when the value of a particular attribute changes." This limitation recites a linkage between instance information and cardinality information; i.e., each time the number of instances changes, the corresponding cardinality element changes. This linkage was described in the specification in connection with, for example, embodiments of the invention, where changes in instance information result in changes in cardinality elements; the cardinality elements being used in these embodiments to associate instances with values and/or values with instances.

With respect to claim 26, the Office Action alleges that the limitations of "a collection of a number of instances corresponding to a value of a first attribute; a cardinality element corresponding to the number of instances; wherein the value can be derived from the cardinality element and wherein at least one instance indicates at least one other instance corresponding to a value of a second attribute and the second attribute is different from the

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first attribute," are taught by the Schiefer's Abstract, disclosure at col. 2, ll. 41-56, discussed above, and col. 8, ll. 11-19.

Applicant respectfully disagrees. Schiefer's supplemental disclosure recited in the Office Action reads as follows:

> With respect to this first method step, the effect of the local predicates must be incorporated in the join result sizes because local predicates can reduce the number of tuples participating in the join. When the local predicate is on the joining attribute, the predicate can also reduce the number of distinct values in the joining attribute. Thus, the local predicates will affect join result sizes since the predicates affect both the number of participating tuples and possibly the number of distinct values in the joining attributes.

The portion of Schiefer cited by the Office Action simply does not disclose, teach or suggest the limitations of claim 26. Indeed, it is unclear as to how the cited disclosure in Schiefer is applied against the limitations of claim 26. In particular, it is unclear which part of the recited disclosure corresponds to applicant's claimed "first attribute" and "second attribute" or to the limitation of "at least one instance indicates at least one other instance corresponding to a value . . .," as recited in claim 26. Should the rejection of claim 26 be maintained, applicant respectfully requests a specific indication as to how Schiefer's teachings are applied to the individual claim limitations.

With respect to claim 27, the Office Action alleges that the limitation of "for at least two tuples having identical first attribute values and identical second attribute values, a single instance element that identifies the first attribute value and the second attribute value, and a cardinality element comprising information regarding the number of tuples having the identical first and second attribute values" is taught by Schiefer's Abstract, discussed above, and Schiefer's disclosure at col. 1, ll. 11-19, which reads as follows:

> Broadly conceived, the present invention relates to relational database management systems, and in particular, to methods for choosing join selectivities in the art of query optimization.

BACKGROUND HISTORY

> Computer systems employ a relational database management system or a RDBMS which is a computer program that manages data storage and retrieval.

Once again, it is unclear as to exactly how Schiefer's Abstract and the text at col. 1, ll. 11-19 disclose or teach the limitations of claim 27. Should the rejection be maintained, applicant

respectfully requests a specific showing and explanation of such teaching and how it is applied to the individual claim limitations.

Claim 28 is patentable at least because it depends on patentable claim 27. Additionally, the limitation of claim 28 "wherein the instance element comprises the cardinality element" does not appear to be taught by the Schiefer's Abstract, contrary to the Office Action's allegations.
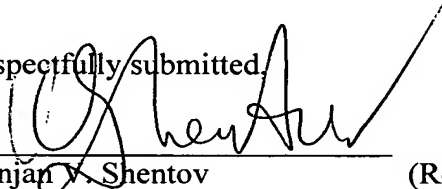
With respect to claims 29-30, 37 C.F.R. 1.104(2) states that ". . .When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable. The pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified." The Office Action fails to identify relevant parts of the Schiefer reference used to reject claims 29-30 and did not explain the basis for the rejections. To the extent the Office Action used the same parts of the Schiefer's disclosure as it used to reject claims 25-28, the July 21, 2006 Response, and the discussion above, make it clear that such rejections are improper and should be withdrawn. Should Schiefer remain the basis of obviousness rejection of claims 29-30, applicant respectfully requests that specific parts of the Schiefer's disclosure be designated.

Conclusions

In light of the above remarks, applicant respectfully requests that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney if a telephone call could help resolve any remaining items.

Respectfully submitted,

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